

CPC**COOPERATIVE PATENT CLASSIFICATION****F04C****ROTARY-PISTON, OR OSCILLATING-PISTON,
POSITIVE-DISPLACEMENT MACHINES FOR LIQUIDS (engines [F03C](#));
ROTARY-PISTON, OR OSCILLATING-PISTON,
POSITIVE-DISPLACEMENT PUMPS****NOTE**

Attention is drawn to the notes preceding class [F01](#) especially as regards the definitions of "machines", "pumps", "positive displacement", "rotary-piston machines", "oscillating-piston machines", "rotary piston", "co-operating members", "movement of co-operating members", "teeth or tooth-equivalents" and "internal axis".

F04C 2/00

Rotary-piston machines or pumps (with non-parallel axes of co-operating members [F04C 3/00](#); with the working-chamber walls at least partly resiliently deformable [F04C 5/00](#); with fluid ring or the like [F04C 7/00](#); rotary-piston pumps specially adapted for elastic fluids [F04C 18/00](#); rotary-piston machines or pumps in which the working-fluid is exclusively displaced by, or exclusively displaces, one or more reciprocating pistons [F04B](#))

NOTE

Group [F04C 2/30](#) takes precedence over groups [F04C 2/02](#) to [F04C 2/28](#)

F04C 2/02

- . of arcuate-engagement type, i.e. with circular translatory movement of co-operating members, each member having the same number of teeth or tooth-equivalents

F04C 2/025

- .. { the moving and the stationary member having co-operating elements in spiral form }

F04C 2/04

- .. of internal axis type

F04C 2/045

- ... { having a C-shaped piston }

F04C 2/06

- .. of other than internal-axis type ([F04C 2/063](#) takes precedence)

F04C 2/063

- .. with coaxially-mounted members having continuously-changing circumferential spacing between them

F04C 2/067

- ... having cam-and-follower type drive

F04C 2/07

- ... having crankshaft-and-connecting-rod type drive

F04C 2/073

- ... having pawl-and-ratchet type drive

F04C 2/077

- ... having toothed-gearing type drive

F04C 2/08

- . of intermeshing-engagement type, i.e. with engagement of co-operating members similar to that of toothed gearing

F04C 2/082

- .. { Details specially related to intermeshing engagement type machines or pumps }

F04C 2/084

- ... { Toothed wheels }

F04C 2/086

- ... { Carter }

F04C 2/088

- ... { Elements in the toothed wheels or the carter for relieving the pressure of fluid imprisoned in the zones of engagement }

- F04C 2/10 . . of internal-axis type with the outer member having more teeth or tooth-equivalents, e.g. rollers, than the inner member
- F04C 2/101 . . . { with a crescent-shaped filler element, located between the inner and outer intermeshing members }
- F04C 2/102 . . . { the two members rotating simultaneously around their respective axes }
- F04C 2/103 . . . { one member having simultaneously a rotational movement about its own axis and an orbital movement }
- F04C 2/104 { having an articulated driving shaft }
- F04C 2/105 { Details concerning timing or distribution valves }
- F04C 2/106 { Spool type distribution valves }
- F04C 2/107 . . . with helical teeth
- F04C 2/1071 { the inner and outer member having a different number of threads and one of the two being made of elastic materials, e.g. Moineau type }
- F04C 2/1073 { where one member is stationary while the other member rotates and orbits }
- F04C 2/1075 { Construction of the stationary member }
- F04C 2/1076 { where one member orbits or wobbles relative to the other member which rotates around a fixed axis }
- F04C 2/1078 { where one member rotates and both members are allowed to orbit or wobble }
- F04C 2/113 . . . the inner member carrying rollers intermeshing with the outer member
- F04C 2/12 . . of other than internal-axis type
- F04C 2/123 . . . { with radially or approximately radially from the rotor body extending tooth-like elements, co-operating with recesses in the other rotor, e.g. one tooth }
- F04C 2/126 . . . { with radially from the rotor body extending elements, not necessarily co-operating with corresponding recesses in the other rotor, e.g. lobes, Roots type }
- F04C 2/14 . . . with toothed rotary pistons
- F04C 2/16 with helical teeth, e.g. chevron-shaped, screw type { ([for non-parallel axes of movement F04C 3/00](#)) }
- F04C 2/165 { having more than two rotary pistons with parallel axes }
- F04C 2/18 with similar tooth forms ([F04C 2/16 takes precedence](#))
- F04C 2/20 with dissimilar tooth forms ([F04C 2/16 takes precedence](#))
- F04C 2/22 . of internal-axis type with equidirectional movement of co-operating members at the points of engagement, or with one of the co-operating members being stationary, the inner member having more teeth or tooth-equivalents than the outer member
- F04C 2/24 . of counter-engagement type, i.e. the movement of co-operating members at the points of engagement being in opposite directions
- F04C 2/26 . . of internal-axis type
- F04C 2/28 . . of other than internal-axis type
- F04C 2/30 . having the characteristics covered by two or more groups [F04C 2/02](#), [F04C 2/08](#), [F04C 2/22](#), [F04C 2/24](#) or having the characteristics covered by one of these groups together with some other type of movement between co-operating members
- F04C 2/32 . . having both the movement defined in groups [F04C 2/02](#) and relative reciprocation between co-operating members

F04C 2/321	...	{ with vanes hinged to the inner member and reciprocating with respect to the inner member }
F04C 2/322	...	{ with vanes hinged to the outer member and reciprocating with respect to the outer member }
F04C 2/324	...	with vanes hinged to the inner member and reciprocating with respect to the outer member
F04C 2/328	....	and hinged to the outer member
F04C 2/332	...	with vanes hinged to the outer member and reciprocating with respect to the inner member
F04C 2/336	....	and hinged to the inner member
F04C 2/34	..	having the movement defined in groups F04C 2/08 or F04C 2/22 and relative reciprocation between the co-operating members
F04C 2/344	...	with vanes reciprocating with respect to the inner member
F04C 2/3441	....	{ the inner and outer member being in contact along one line or continuous surface substantially parallel to the axis of rotation }
F04C 2/3442	.....	{ the surfaces of the inner and outer member, forming the working space, being surfaces of revolution }
F04C 2/3443	.....	{ with a separation element located between the inlet and outlet opening }
F04C 2/3445	.....	{ the vanes having the form of rollers, slippers or the like }
F04C 2/3446	....	{ the inner and outer member being in contact along more than one line or surface }
F04C 2/3447	.....	{ the vanes having the form of rollers, slippers or the like }
F04C 2/3448	....	{ with axially movable vanes }
F04C 2/348	....	the vanes positively engaging, with circumferential play, an outer rotatable member
F04C 2/352	....	the vanes being pivoted on the axis of the outer member
F04C 2/356	...	with vanes reciprocating with respect to the outer member
F04C 2/3562	....	{ the inner and outer member being in contact along one line or continuous surface substantially parallel to the axis of rotation }
F04C 2/3564	.....	{ the surfaces of the inner and outer member, forming the working space, being surfaces of revolution }
F04C 2/3566	....	{ the inner and outer member being in contact along more than one line or surface }
F04C 2/3568	....	{ with axially movable vanes }
F04C 2/36	..	having both the movements defined in groups F04C 2/22 and F04C 2/24
F04C 2/38	..	having the movement defined in group F04C 2/02 and having a hinged member (F04C 2/32 takes precedence)
F04C 2/39	...	with vanes hinged to the inner as well as to the outer member
F04C 2/40	..	having the movement defined in group F04C 2/08 or F04C 2/22 and having a hinged member
F04C 2/44	...	with vanes hinged to the inner member
F04C 2/46	...	with vanes hinged to the outer member

F04C 3/00 Rotary-piston machines or pumps, with non-parallel axes of movement of co-operating members, e.g. of screw type (with the working-chamber walls at least partly resiliently deformable [F04C 5/00](#); rotary-piston pumps with non-parallel axes of movement of co-operating members specially adapted for elastic fluids [F04C 18/48](#))

- F04C 3/02 . the axes being arranged at an angle of 90 degrees
- F04C 3/04 . . of intermeshing engagement type, i.e. with engagement of co-operating members similar to that of toothed gearing
- F04C 3/06 . the axes being arranged otherwise than at an angle of 90 degrees
- F04C 3/08 . . of intermeshing engagement type, i.e. with engagement of co-operating members similar to that of toothed gearing
- F04C 3/085 . . . { the axes of cooperating members being on the same plane }
- F04C 5/00 Rotary-piston machines or pumps with the working-chamber walls at least partly resiliently deformable (such pumps specially adapted for elastic fluids [F04C 18/00](#))**
- F04C 7/00 Rotary-piston machines or pumps with fluid ring or the like (such pumps specially adapted for elastic fluids [F04C 19/00](#))**
- F04C 9/00 Oscillating-piston machines or pumps (such pumps specially adapted for elastic fluids [F04C 21/00](#))**
- F04C 9/002 . { the piston oscillating around a fixed axis }
- F04C 9/005 . { the piston oscillating in the space, e.g. around a fixed point (rotary-piston machines or pumps with non-parallel axes of movement between co-operating members [F04C 3/00](#)) }
- F04C 9/007 . { the points of the moving element describing approximately an alternating movement in axial direction with respect to the other element }
- F04C 11/00 Combinations of two or more machines or pumps, each being of rotary-piston or oscillating-piston type (combinations of such pumps specially adapted for elastic fluids [F04C 23/00](#)); Pumping installations ([F04C 13/00](#) takes precedence; specially adapted for elastic fluids [F04C 23/00](#); fluid gearing [F16H](#))**
- NOTE**
- Multi-stage engines, motors, pumps or compressors with stages connected in series or in parallel are not considered as having complementary function
- F04C 11/001 . { of similar working principle }
- F04C 11/003 . . { having complementary function }
- F04C 11/005 . { of dissimilar working principle }
- F04C 11/006 . . { having complementary function }
- F04C 11/008 . { Enclosed motor pump units }
- F04C 13/00 Adaptations of machines or pumps for special use, e.g. for extremely high pressures (of pumps specially adapted for elastic fluids [F04C 25/00](#))**

- F04C 13/001 . { Pumps for particular liquids }
- F04C 13/002 . . { for homogeneous viscous liquids }
- F04C 13/004 . . . { with means for fluidising or diluting the material being pumped }
- F04C 13/005 . { Removing contaminants, deposits or scale from the pump; Cleaning }
- F04C 13/007 . { Venting; Gas and vapour separation during pumping (preventing vapour lock in fuel pumps [F02M 37/20](#), in centrifugal pumps [F04D 9/00](#)) }
- F04C 13/008 . { Pumps for submersible use, i.e. down-hole pumping }
- F04C 14/00** **Control of, monitoring of, or safety arrangements for, machines, pumps or pumping installations (of pumps or pumping installations specially adapted for elastic fluids [F04C 28/00](#))**
- F04C 14/02 . specially adapted for several machines or pumps connected in series or in parallel
- F04C 14/04 . specially adapted for reversible machines or pumps
- F04C 14/06 . specially adapted for stopping, starting, idling or no-load operation
- F04C 14/065 . . { Capacity control using a multiplicity of units or pumping capacities, e.g. multiple chambers, individually switchable or controllable }
- F04C 14/08 . characterised by varying the rotational speed
- F04C 14/10 . characterised by changing the positions of the inlet or outlet openings with respect to the working chamber
- F04C 14/12 . . using sliding valves
- F04C 14/14 . . using rotating valves
- F04C 14/16 . . using lift valves
- F04C 14/18 . characterised by varying the volume of the working chamber (by changing the positions of inlet or outlet openings [F04C 14/10](#))
- F04C 14/185 . . { by varying the useful pumping length of the cooperating members in the axial direction }
- F04C 14/20 . . by changing the form of the inner or outer contour of the working chamber
- F04C 14/22 . . by changing the eccentricity between cooperating members
- F04C 14/223 . . . { using a movable cam }
- F04C 14/226 { by pivoting the cam around an eccentric axis }
- F04C 14/24 . characterised by using valves regulating pressure or flow rate, e.g. discharge valves, { unloading valves } ([F04C 14/10](#) takes precedence)
- F04C 14/26 . . using bypass channels
- F04C 14/265 . . . { being obtained by displacing a lateral sealing face }
- F04C 14/28 . Safety arrangements; Monitoring
- F04C 15/00** **Component parts, details or accessories of machines, pumps or pumping installations, not provided for in groups [F04C 2/00](#) to [F04C 14/00](#) (of pumps specially**

adapted for elastic fluids [F04C 18/00](#) to [F04C 29/00](#))

- F04C 15/0003 . { Sealing arrangements in rotary-piston machines or pumps ([sealing in general F16J](#)) }
- F04C 15/0007 .. { Radial sealings for working fluid }
- F04C 15/0011 ... { of rigid material }
- F04C 15/0015 ... { of resilient material }
- F04C 15/0019 ... { Radial sealing elements specially adapted for intermeshing-engagement type machines or pumps, e.g. gear machines or pumps }
- F04C 15/0023 .. { Axial sealings for working fluid }
- F04C 15/0026 ... { Elements specially adapted for sealing of the lateral faces of intermeshing-engagement type machines or pumps, e.g. gear machines or pumps }
- F04C 15/003 .. { Sealings for working fluid between radially and axially moving parts }
- F04C 15/0034 .. { for other than the working fluid, i.e. the sealing arrangements are not between working chambers of the machine }
- F04C 15/0038 ... { Shaft sealings specially adapted for rotary-piston machines or pumps }
- F04C 15/0042 . { Systems for the equilibration of forces acting on the machines or pump ([interstice adjustment other than by fluid pressure F01C 21/102](#)) }
- F04C 15/0046 .. { Internal leakage control }
- F04C 15/0049 .. { Equalization of pressure pulses ([silencing for compressors F04C 29/06](#)) }
- F04C 15/0053 . { Venting means for starting }
- F04C 15/0057 . { Driving elements, brakes, couplings, transmission specially adapted for machines or pumps ([brakes, couplings, transmissions per se F16](#) , [B60](#)) }
- F04C 15/0061 .. { Means for transmitting movement from the prime mover to driven parts of the pump, e.g. clutches, couplings, transmissions }
- F04C 15/0065 ... { for eccentric movement }
- F04C 15/0069 ... { Magnetic couplings }
- F04C 15/0073 ... { Couplings between rotors and input or output shafts acting by interengaging or mating parts, i.e. positive coupling of rotor and shaft }
- F04C 15/0076 .. { Fixing rotors on shafts, e.g. by clamping together hub and shaft }
- F04C 15/008 .. { Prime movers }
- F04C 15/0084 .. { Brakes, braking assemblies }
- F04C 15/0088 . { Lubrication ([of machines or engines in general F01M](#)) }
- F04C 15/0092 .. { Control systems for the circulation of the lubricant }
- F04C 15/0096 . { Heating; Cooling ([of machines or engines in general F01P](#)) }
- F04C 15/06 . Arrangements for admission or discharge of the working fluid, e.g. constructional features of the inlet or outlet
- F04C 15/062 .. { Arrangements for supercharging the working space ([similar arrangements for internal combustion engines F02B 33/00](#), [F02B 37/00](#)) }
- F04C 15/064 .. { with inlet and outlet valves specially adapted for rotary or oscillating piston }

machines or pumps }

F04C 15/066 . . . { of the non-return type }

F04C 15/068 { of the elastic type, e.g. reed valves }

F04C 18/00

Rotary-piston pumps specially adapted for elastic fluids (with fluid ring or the like [F04C 19/00](#); rotary-piston pumps in which the working-fluid is exclusively displaced by one or more reciprocating pistons [F04B](#))

NOTE

Group [F04C 18/30](#) takes precedence over groups [F04C 18/02](#) to [F04C 18/28](#) and [F04C 18/48](#) to [F04C 18/56](#).

F04C 18/02 . of arcuate-engagement type, i.e. with circular translatory movement of co-operating members, each member having the same number of teeth or tooth-equivalents

F04C 18/0207 . . { both members having co-operating elements in spiral form }

F04C 18/0215 . . . { where only one member is moving }

F04C 18/0223 { with symmetrical double wraps }

F04C 18/023 . . . { where both members are moving }

F04C 18/0238 { with symmetrical double wraps }

F04C 18/0246 . . . { Details concerning the involute wraps or their base, e.g. geometry }

F04C 18/0253 { Details concerning the base }

F04C 18/0261 { Details of the ports, e.g. location, number, geometry }

F04C 18/0269 { Details concerning the involute wraps }

F04C 18/0276 { Different wall heights }

F04C 18/0284 { Details of the wrap tips }

F04C 18/0292 { Ports or channels located in the wrap }

F04C 18/04 . . of internal-axis type

F04C 18/045 . . . { having a C-shaped piston }

F04C 18/06 . . of other than internal-axis type

F04C 18/063 . . with coaxially-mounted members having continuously-changing circumferential spacing between them

F04C 18/067 . . . having cam-and-follower type drive

F04C 18/07 . . . having crankshaft-and-connecting-rod type drive

F04C 18/073 . . . having pawl-and-ratchet type drive

F04C 18/077 . . . having toothed-gearing type drive

F04C 18/08 . of intermeshing-engagement type, i.e. with engagement of co-operating members similar to that of toothed gearing

F04C 18/082 . . { Details specially related to intermeshing engagement type pumps }

F04C 18/084 . . . { Toothed wheels }

F04C 18/086 . . . { Carter }

F04C 18/088 . . . { Elements in the toothed wheels or the carter for relieving the pressure of fluid imprisoned in the zones of engagement }

F04C 18/10 . . of internal-axis type with the outer member having more teeth or tooth equivalents,

- e.g. rollers, than the inner member
- F04C 18/103 . . . { with a crescent shaped filler element, located between the inner and outer intermeshing elements }
 - F04C 18/107 . . . with helical teeth
 - F04C 18/1075 { the inner and outer member having a different number of threads and one of the two being made of elastic material, e.g. Moineau type }
 - F04C 18/113 . . . the inner member carrying rollers intermeshing with the outer member
 - F04C 18/12 . . of other than internal-axis type
 - F04C 18/123 . . . { with radially or approximately radially from the rotor body extending tooth-like elements, co-operating with recesses in the other rotor, e.g. one tooth }
 - F04C 18/126 . . . { with radially from the rotor body extending elements, not necessarily co-operating with corresponding recesses in the other rotor, e.g. lobes, Roots type }
 - F04C 18/14 . . . with toothed rotary pistons
 - F04C 18/16 with helical teeth, e.g. chevron-shaped, screw type { (for non-parallel axes of movement [F04C 18/48](#)) }
 - F04C 18/165 { having more than two rotary pistons with parallel axes }
 - F04C 18/18 with similar tooth forms ([F04C 18/16](#) takes precedence)
 - F04C 18/20 with dissimilar tooth forms ([F04C 18/16](#) takes precedence)
 - F04C 18/22 . of internal-axis type with equidirectional movement of co-operating members at the points of engagement, or with one of the co-operating members being stationary, the inner member having more teeth or tooth equivalents than the outer member
 - F04C 18/24 . of counter-engagement type, i.e. the movement of co-operating members at the points of engagement being in opposite directions
 - F04C 18/26 . . of internal-axis type
 - F04C 18/28 . . of other than internal-axis type
 - F04C 18/30 . having the characteristics covered by two or more of groups [F04C 18/02](#), [F04C 18/08](#), [F04C 18/22](#), [F04C 18/24](#), [F04C 18/48](#), or having the characteristics covered by one of these groups together with some other type of movement between co-operating members
 - F04C 18/32 . . having both the movement defined in group [F04C 18/02](#) and relative reciprocation between the co-operating members
 - F04C 18/321 . . . { with vanes hinged to the inner member and reciprocating with respect to the inner member }
 - F04C 18/322 . . . { with vanes hinged to the outer member and reciprocating with respect to the outer member }
 - F04C 18/324 . . . with vanes hinged to the inner member and reciprocating with respect to the outer member
 - F04C 18/328 and hinged to the outer member
 - F04C 18/332 . . . with vanes hinged to the outer member and reciprocating with respect to the inner member
 - F04C 18/336 and hinged to the inner member
 - F04C 18/34 . . having the movement defined in group [F04C 18/08](#) or [F04C 18/22](#) and relative reciprocation between the co-operating members
 - F04C 18/344 . . . with vanes reciprocating with respect to the inner member
 - F04C 18/3441 { the inner and outer member being in contact along one line or continuous

- surface substantially parallel to the axis of rotation }
- F04C 18/3442 { the surfaces of the inner and outer member, forming the inlet and outlet opening }
- F04C 18/3443 { with a separation element located between the inlet and outlet opening }
- F04C 18/3445 { the vanes having the form of rollers, slippers or the like }
- F04C 18/3446 { the inner and outer member being in contact along more than one line or surface }
- F04C 18/3447 { the vanes having the form of rollers, slippers or the like }
- F04C 18/3448 { with axially movable vanes }
- F04C 18/348 the vanes positively engaging, with circumferential play, an outer rotatable member
- F04C 18/352 the vanes being pivoted on the axis of the outer member
- F04C 18/356 with vanes reciprocating with respect to the outer member
- F04C 18/3562 { the inner and outer member being in contact along one line or continuous surfaces substantially parallel to the axis of rotation }
- F04C 18/3564 { the surfaces of the inner and outer member, forming the working space, being surfaces of revolution }
- F04C 18/3566 { the inner and outer member being in contact along more than line or surface }
- F04C 18/3568 { with axially movable vanes }
- F04C 18/36 having both the movement defined in groups [F04C 18/22](#) and [F04C 18/24](#)
- F04C 18/38 having the movement defined in group [F04C 18/02](#) and having a hinged member ([F04C 18/32](#) takes precedence)
- F04C 18/39 with vanes hinged to the inner as well as to the outer member
- F04C 18/40 having the movement defined in group [F04C 18/08](#) or [F04C 18/22](#) and having a hinged member
- F04C 18/44 with vanes hinged to the inner member
- F04C 18/46 with vanes hinged to the outer member
- F04C 18/48 Rotary-piston pumps with non-parallel axes of movement of co-operating members
- F04C 18/50 the axes being arranged at an angle of 90 degrees
- F04C 18/52 of intermeshing engagement type, i.e. with engagement of co-operating members similar to that of toothed gearing
- F04C 18/54 the axes being arranged otherwise than at an angle of 90 degrees
- F04C 18/56 of intermeshing engagement type, i.e. with engagement of co-operating members similar to that of toothed gearing
- F04C 18/565 { the axes of cooperating members being on the same plane }
- F04C 19/00** **Rotary-piston pumps with fluid ring or the like, specially adapted for elastic fluids**
- F04C 19/001 { General arrangements, plants, flowsheets }
- F04C 19/002 { with rotating outer members }
- F04C 19/004 { Details concerning the operating liquid, e.g. nature, separation, cooling, cleaning, control of the supply }
- F04C 19/005 { Details concerning the admission or discharge }

- F04C 19/007 . . { Port members in the form of side plates }
- F04C 19/008 . . { Port members in the form of conical or cylindrical pieces situated in the centre of the impeller }

F04C 21/00 Oscillating-piston pumps specially adapted for elastic fluids

- F04C 21/002 . { the piston oscillating around a fixed axis }
- F04C 21/005 . { the piston oscillating in the space, e.g. around a fixed point (rotary-piston pumps with non-parallel axes of rotation between co-operating members [F04C 18/48](#)) }
- F04C 21/007 . { the points of the moving element describing approximately an alternating movement in axial direction with respect to the other element }

F04C 23/00 Combinations of two or more pumps, each being of rotary-piston or oscillating-piston type, specially adapted for elastic fluids; Pumping installations specially adapted for elastic fluids; Multi-stage pumps specially adapted for elastic fluids ([F04C 25/00](#) takes precedence)

NOTE

Multi-stage pumps or compressors with stages connected in series or in parallel are not considered as having complementary function

- F04C 23/001 . { of similar working principle }
- F04C 23/003 . . { having complementary function }
- F04C 23/005 . { of dissimilar working principle }
- F04C 23/006 . . { having complementary function }
- F04C 23/008 . { Hermetic pumps }

NOTE

Multi-stage steam engines, motors, pumps or compressors with stages connected in series or in parallel are not considered as having complementary function

- F04C 23/02 . Pumps characterised by combination with or adaptation to specific driving engines or motors ([predominant aspects of the engines or motors, see the relevant classes](#))

F04C 25/00 Adaptations of pumps for special use of pumps for elastic fluids

- F04C 25/02 . for producing high vacuum ([sealing arrangements](#) [F04C 27/00](#); [silencing](#) [F04C 29/06](#))

F04C 27/00 Sealing arrangements in rotary-piston pumps specially adapted for elastic fluids

- F04C 27/001 . { Radial sealings for working fluid }

- F04C 27/002 . . { of rigid material }
- F04C 27/003 . . { of resilient material }
- F04C 27/004 . . { Radial sealing elements specially adapted for intermeshing-engagement type pumps, e.g. gear pumps }

- F04C 27/005 . { Axial sealings for working fluid }
- F04C 27/006 . . { Elements specially adapted for sealing of the lateral faces of intermeshing-engagement type pumps, e.g. gear pumps }

- F04C 27/007 . { Sealings for working fluid between radially and axially moving parts }

- F04C 27/008 . { for other than working fluid, i.e. the sealing arrangements are not between working chambers of the machine }
- F04C 27/009 . . { Shaft sealings specially adapted for pumps }

- F04C 27/02 . Liquid sealing for high-vacuum pumps { or for compressors }

- F04C 28/00 Control of, monitoring of, or safety arrangements for, pumps or pumping installations specially adapted for elastic fluids**

- F04C 28/02 . specially adapted for several pumps connected in series or in parallel
- F04C 28/04 . specially adapted for reversible pumps
- F04C 28/06 . specially adapted for stopping, starting, idling or no-load operation
- F04C 28/065 . . { Capacity control using a multiplicity of units or pumping capacities, e.g. multiple chambers, individually switchable or controllable }

- F04C 28/08 . characterised by varying the rotational speed

- F04C 28/10 . characterised by changing the positions of the inlet or outlet openings with respect to the working chamber
- F04C 28/12 . . using sliding valves
- F04C 28/125 . . . { with sliding valves controlled by the use of fluid other than the working fluid }
- F04C 28/14 . . using rotating valves
- F04C 28/16 . . using lift valves

- F04C 28/18 . characterised by varying the volume of the working chamber (by changing the positions of inlet or outlet openings [F04C 28/10](#))
- F04C 28/185 . . { by varying the useful pumping length of the cooperating members in the axial direction }
- F04C 28/20 . . by changing the form of the inner or outer contour of the working chamber
- F04C 28/22 . . by changing the eccentricity between cooperating members

- F04C 28/24 . characterised by using valves regulating pressure or flow rate, e.g. discharge valves { unloading valves } ([F04C 28/10](#) takes precedence)
- F04C 28/26 . . using bypass channels
- F04C 28/265 . . . { being obtained by displacing a lateral sealing face }

- F04C 28/28 . Safety arrangements; Monitoring

- F04C 29/00** **Component parts, details or accessories of pumps or pumping installations, not provided for in groups [F04C 18/00](#) to [F04C 28/00](#)**
- F04C 29/0007 . { Injection of a fluid in the working chamber for sealing, cooling and lubricating (sealing only [F04C 27/00](#); lubrication only [F04C 29/02](#); cooling [F02B 47/02](#), [F02D 21/00](#), [F02M 25/00](#)) }
 - F04C 29/0014 .. { with control systems for the injection of the fluid }
 - F04C 29/0021 . { Systems for the equilibration of forces acting on the pump } (interstice adjustment other than by fluid pressure [F01C 21/102](#))
 - F04C 29/0028 .. { Internal leakage control }
 - F04C 29/0035 .. { Equalization of pressure pulses (silencing [F04C 29/06](#)) }
 - F04C 29/0042 . { Driving elements, brakes, couplings, transmissions specially adapted for pumps (brakes, couplings, transmissions per se [F16](#) , [B60](#)) }
 - F04C 29/005 .. { Means for transmitting movement from the prime mover to driven parts of the pump, e.g. clutches, couplings, transmissions }
 - F04C 29/0057 ... { for eccentric movement }
 - F04C 29/0064 ... { Magnetic couplings }
 - F04C 29/0071 ... { Couplings between rotors and input or output shafts acting by interengaging or mating parts, i.e. positive coupling of rotor and shaft }
 - F04C 29/0078 .. { Fixing rotors on shafts, e.g. by clamping together hub and shaft }
 - F04C 29/0085 .. { Prime movers }
 - F04C 29/0092 . { Removing solid or liquid contaminants from the gas under pumping, e.g. by filtering or deposition; Purging; Scrubbing; Cleaning }
 - F04C 29/02 . Lubrication (of machines or engines in general [F01M](#)); Lubricant separation (separation in general [B01D](#))
 - F04C 29/021 .. { Control systems for the circulation of the lubricant }
 - F04C 29/023 .. { Lubricant distribution through a hollow driving shaft ([F04C 29/025](#) takes precedence) }
 - F04C 29/025 .. { using a lubricant pump }
 - F04C 29/026 .. { Lubricant separation }
 - F04C 29/028 .. { Means for improving or restricting lubricant flow }
 - F04C 29/04 . Heating; Cooling (of machines or engines in general [F01P](#)); Heat insulation (heat insulation in general [F16L 59/00](#))
 - F04C 29/042 .. { by injecting a fluid (injection of fluid for sealing, cooling or lubrication [F04C 29/0007](#)) }
 - F04C 29/045 .. { of the electric motor in hermetic pumps }
 - F04C 29/047 .. { Cooling of electronic devices installed inside the pump housing, e.g. inverters }
- WARNING**
- WARNING this group is pending a reorganisation, see also [F04C 29/04](#)
- F04C 29/06 . Silencing (gas-flow silencers or exhaust apparatus for machines or engines in general [F01N](#))

WARNING

{ WARNING Subgroups [F04C 29/061](#) to [F04C 29/068](#) pending a reorganisation, see also [F04C 29/06](#) }

- [F04C 29/061](#) .. { Silencers using overlapping frequencies, e.g. Helmholtz resonators }
- [F04C 29/063](#) .. { Sound absorbing materials }
- [F04C 29/065](#) .. { Noise dampening volumes, e.g. muffler chambers }
- [F04C 29/066](#) ... { with means to enclose the source of noise }
- [F04C 29/068](#) .. { the silencing means being arranged inside the pump housing }

- [F04C 29/12](#) . Arrangements for admission or discharge of the working fluid, e.g. constructional features of the inlet or outlet
- [F04C 29/122](#) .. { Arrangements for supercharging the working space (similar arrangements for internal combustion engines [F02B 33/00](#), [F02B 37/00](#)) }
- [F04C 29/124](#) .. { with inlet and outlet valves specially adapted for rotary or oscillating piston pumps }
- [F04C 29/126](#) ... { of the non-return type }
- [F04C 29/128](#) { of the elastic type, e.g. reed valves }

[F04C 2210/00](#)**Fluid**

- [F04C 2210/10](#) . working
- [F04C 2210/1005](#) .. Air
- [F04C 2210/1011](#) .. Amine
- [F04C 2210/1016](#) .. Blood
- [F04C 2210/1022](#) .. C3HmFn
- [F04C 2210/1027](#) .. CO2
- [F04C 2210/1033](#) .. Concrete
- [F04C 2210/1038](#) .. Cooking oil
- [F04C 2210/1044](#) .. Fuel
- [F04C 2210/105](#) .. Helium (He)
- [F04C 2210/1055](#) .. Hydrogen (H2)
- [F04C 2210/1061](#) .. LPG
- [F04C 2210/1066](#) .. Nitrogen (N2)
- [F04C 2210/1072](#) .. Oxygen (O2)
- [F04C 2210/1077](#) .. Steam
- [F04C 2210/1083](#) .. Urea
- [F04C 2210/1088](#) .. Vegetable oil
- [F04C 2210/1094](#) .. Water

- [F04C 2210/12](#) . auxiliary
- [F04C 2210/122](#) .. Nitrogen (N2)
- [F04C 2210/124](#) .. Sodium (Na)

F04C 2210/126	..	Tin
F04C 2210/128	..	Water
F04C 2210/14	.	Lubricant
F04C 2210/142	..	Ester
F04C 2210/145	..	PAG
F04C 2210/147	..	Water
F04C 2210/20	.	liquid, i.e. incompressible
F04C 2210/201	..	DME
F04C 2210/203	..	Fuel
F04C 2210/205	..	Ink
F04C 2210/206	..	Oil
F04C 2210/208	..	Water
F04C 2210/22	.	gaseous, i.e. compressible
F04C 2210/221	..	Air
F04C 2210/222	..	Carbon dioxide (CO ₂)
F04C 2210/224	..	Hydrogen (H ₂)
F04C 2210/225	..	Nitrogen (N ₂)
F04C 2210/227	..	Steam
F04C 2210/228	..	Vapour
F04C 2210/24	.	mixed, e.g. two-phase fluid
F04C 2210/242	..	Steam
F04C 2210/245	..	Vapour
F04C 2210/247	..	Water
F04C 2210/26	.	Refrigerants with particular properties, e.g. HFC- 134a
F04C 2210/261	..	Carbon dioxide (CO ₂)
F04C 2210/263	..	HFO1234YF
F04C 2210/265	..	Ammoniac (NH ₃)
F04C 2210/266	..	Propane
F04C 2210/268	..	R32
F04C 2210/40	.	Properties
F04C 2210/42	..	magnetic or ferromagnetic; Ferrofluids
F04C 2210/44	..	Viscosity
F04C 2210/60	.	Condition
F04C 2210/62	..	Purity
F04C 2220/00		Application
F04C 2220/10	.	Vacuum

- F04C 2220/12 . . Dry running
- F04C 2220/20 . Pumps with means for separating and evacuating the gaseous phase
- F04C 2220/22 . for very low temperatures, i.e. cryogenic
- F04C 2220/24 . for metering throughflow
- F04C 2220/26 . for step-by-step output movement
- F04C 2220/28 . for pulsed fluid flow
- F04C 2220/30 . Use in a chemical vapor deposition (CVD) process or in a similar process
- F04C 2220/40 . Pumps with means for venting areas other than the working chamber, e.g. bearings, gear chambers, shaft seals
- F04C 2220/50 . Pumps with means for introducing gas under pressure for ballasting

F04C 2230/00 Manufacture

NOTE

Manufacture comprises also treatment, assembly or disassembly methods, repairing, handling or the like.

- F04C 2230/10 . by removing material
- F04C 2230/101 . . by electrochemical methods
- F04C 2230/102 . . by spark erosion methods
- F04C 2230/103 . . using lasers
- F04C 2230/20 . essentially without removing material
- F04C 2230/21 . . by casting
- F04C 2230/22 . . by sintering
- F04C 2230/23 . . by permanently joining parts together
- F04C 2230/231 . . . by welding
- F04C 2230/24 . . by extrusion
- F04C 2230/25 . . by forging
- F04C 2230/26 . . by rolling
- F04C 2230/27 . . by hydroforming
- F04C 2230/40 . Heat treatment
- F04C 2230/41 . . Hardening; Annealing
- F04C 2230/60 . Assembly methods
- F04C 2230/601 . . Adjustment
- F04C 2230/602 . . Gap; Clearance

F04C 2230/603	..	Centering; Aligning
F04C 2230/604	..	Mounting devices for pumps or compressors
F04C 2230/605	..	Balancing
F04C 2230/70	.	Disassembly methods
F04C 2230/80	.	Repairing methods
F04C 2230/85	.	Methods for improvement by repair or exchange of parts
F04C 2230/90	.	Improving properties of machine parts
F04C 2230/91	..	Coating
F04C 2230/92	..	Surface treatment
F04C 2240/00		Components
F04C 2240/10	.	Stators
F04C 2240/102	..	with means for discharging condensate or liquid separated from the gas pumped
F04C 2240/20	.	Rotors
F04C 2240/30	.	Casings or housings
F04C 2240/40	.	Electric motor
F04C 2240/401	..	Linear motor
F04C 2240/402	..	Plurality of electronically synchronised motors
F04C 2240/403	..	with inverter for speed control
F04C 2240/45	.	Hybrid prime mover
F04C 2240/50	.	Bearings
F04C 2240/51	..	for cantilever assemblies
F04C 2240/52	..	for assemblies with supports on both sides
F04C 2240/54	..	Hydrostatic or hydrodynamic bearing assemblies specially adapted for rotary positive displacement pumps or compressors
F04C 2240/56	..	Bearing bushings or details thereof
F04C 2240/60	.	Shafts
F04C 2240/601	..	Shaft flexion
F04C 2240/603	..	with internal channels for fluid distribution, e.g. hollow shaft
F04C 2240/605	..	Shaft sleeves or details thereof
F04C 2240/70	.	Use of multiplicity of similar components; Modular construction
F04C 2240/80	.	Other components
F04C 2240/801	..	Wear plates
F04C 2240/802	..	Liners

F04C 2240/803	..	Electric connectors or cables; Fittings therefor
F04C 2240/804	..	Accumulators for refrigerant circuits
F04C 2240/805	..	Fastening means, e.g. bolts
F04C 2240/806	..	Pipes for fluids; Fittings therefor
F04C 2240/807	..	Balance weight, counterweight
F04C 2240/808	..	Electronic circuits (e.g. inverters) installed inside the machine
F04C 2240/809	..	Lubricant sump
F04C 2240/81	..	Sensor, e.g. electronic sensor for control or monitoring
F04C 2240/811	..	Actuator for control, e.g. pneumatic, hydraulic, electric

F04C 2250/00**Geometry**

F04C 2250/10	.	of the inlet or outlet
F04C 2250/101	..	of the inlet
F04C 2250/102	..	of the outlet
F04C 2250/20	.	of the rotor
F04C 2250/201	..	conical shape
F04C 2250/30	.	of the stator
F04C 2250/301	..	compression chamber profile defined by a mathematical expression or by parameters

F04C 2270/00**Control; Monitoring or safety arrangements**

F04C 2270/01	.	Load
F04C 2270/015	..	Controlled or regulated
F04C 2270/02	.	Power
F04C 2270/025	..	Controlled or regulated
F04C 2270/03	.	Torque
F04C 2270/035	..	Controlled or regulated
F04C 2270/04	.	Force
F04C 2270/041	..	Controlled or regulated
F04C 2270/042	..	radial
F04C 2270/0421	...	Controlled or regulated
F04C 2270/0422	...	centrifugal
F04C 2270/04225	....	Controlled or regulated
F04C 2270/044	..	axial
F04C 2270/0445	...	Controlled or regulated
F04C 2270/05	.	Speed
F04C 2270/051	..	Controlled or regulated

F04C 2270/052	. .	angular
F04C 2270/0525	. . .	Controlled or regulated
F04C 2270/054	. .	linear
F04C 2270/0545	. . .	Controlled or regulated
F04C 2270/06	. .	Acceleration
F04C 2270/065	. .	Controlled or regulated
F04C 2270/07	. .	Electric current
F04C 2270/075	. .	Controlled or regulated
F04C 2270/08	. .	Amplitude of electric current
F04C 2270/085	. .	Controlled or regulated
F04C 2270/09	. .	Electric current frequency
F04C 2270/095	. .	Controlled or regulated
F04C 2270/10	. .	Voltage
F04C 2270/105	. .	Controlled or regulated
F04C 2270/11	. .	Magnetic flux
F04C 2270/115	. .	Controlled or regulated
F04C 2270/12	. .	Vibration
F04C 2270/125	. .	Controlled or regulated
F04C 2270/13	. .	Noise
F04C 2270/135	. .	Controlled or regulated
F04C 2270/14	. .	Pulsations
F04C 2270/145	. .	Controlled or regulated
F04C 2270/15	. .	Resonance
F04C 2270/155	. .	Controlled or regulated
F04C 2270/16	. .	Wear
F04C 2270/165	. .	Controlled or regulated
F04C 2270/17	. .	Tolerance; Play; Gap
F04C 2270/175	. .	Controlled or regulated
F04C 2270/18	. .	Pressure
F04C 2270/185	. .	Controlled or regulated
F04C 2270/19	. .	Temperature
F04C 2270/195	. .	Controlled or regulated
F04C 2270/20	. .	Flow

F04C 2270/205	. .	Controlled or regulated
F04C 2270/21	.	Pressure difference
F04C 2270/215	. .	Controlled or regulated
F04C 2270/22	.	Temperature difference
F04C 2270/225	. .	Controlled or regulated
F04C 2270/23	.	Working cycle timing control
F04C 2270/24	.	Level of liquid, e.g. lubricant or cooling liquid
F04C 2270/40	.	Conditions across a pump or machine
F04C 2270/42	.	Conditions at the inlet of a pump or machine
F04C 2270/44	.	Conditions at the outlet of a pump or machine
F04C 2270/46	.	Conditions in the working chamber
F04C 2270/48	.	Conditions of a reservoir linked to a pump or machine
F04C 2270/50	.	Conditions before a throttle
F04C 2270/52	.	Conditions after a throttle
F04C 2270/54	.	Conditions in a control cylinder/piston unit
F04C 2270/56	.	Number of pump/machine units in operation
F04C 2270/58	.	Valve parameters
F04C 2270/585	. .	Controlled or regulated
F04C 2270/60	.	Prime mover parameters
F04C 2270/605	. .	Controlled or regulated
F04C 2270/70	.	Safety, emergency conditions or requirements
F04C 2270/701	. .	Cold start
F04C 2270/72	. .	preventing reverse rotation
F04C 2270/78	.	Warnings
F04C 2270/782	. .	Sound
F04C 2270/784	. .	Light
F04C 2270/80	.	Diagnostics
F04C 2270/86	.	Detection
F04C 2270/90	.	Remote control, e.g. wireless, via LAN, by radio, or by a wired connection from a central computer

F04C 2280/00

Arrangements for preventing or removing deposits or corrosion

F04C 2280/02

- Preventing solid deposits in pumps, e.g. in vacuum pumps with chemical vapour deposition (CVD) processes

F04C 2280/04

- Preventing corrosion